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(71) Applicant: SHIBAURA ENG WORKS CO LTD

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(72) Inventor: IRIE SHINICHIRO

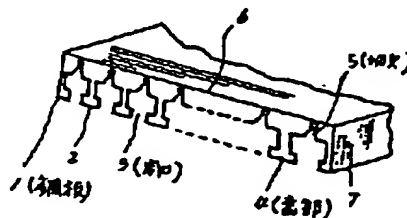
(54) ELECTRIC MOTOR

(57) Abstract

PURPOSE: To enable providing an apparatus with a winding independently of the axial length and inner diameter of said apparatus, by juxtaposing openings with one side of a beltlike steel sheet to form tooth parts and by bending said steel sheet circularly after carrying out winding between said tooth parts.

CONSTITUTION: Openings 3 are juxtaposed with one side 2 of a beltlike steel sheet 1 and each of said openings 3 defines a tooth part 4 together with an adjacent opening 3. A fan-shaped notch 5 is formed in the base of each of said openings 3. Said steel sheets 1 are piled up to form a stator core 7 and said openings 3 are provided with a winding. After that, said stator core 7 is bent circularly with tooth parts 4 as the inner diameter side and inserted into a cylindrical frame.

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**(54) Title of the Invention : Electric Motor**

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(72) Inventor : Shinichiro Irie  
Shibaura Seisakusho K.K., Kohama Plant  
13-10, Ekimae-cho, Kohama-shi, Fukui-ken

(71) Applicant : Shibaura Seisakusho K.K.  
1-12, 1 chome, Akasaka, Minato-ku, Tokyo

### Description

#### 1. Title of the Invention : Electric Motor

#### 2. Scope of the Patent Application

Electric motor characterized by the fact that the teeth parts 4 are formed by providing the large opening 3 on one side 2 of a belt shaped steel sheet 1, and a fan- shaped notch 5 that is extended near the other side 6 of the steel sheet 1 at the bottom part of this opening 3, and the above mentioned steel sheet 1 are made to be a consistent length and also these are laminated and this becomes the stator core 7, and the winding 8 is made between the above mentioned teeth parts 4, and the stator core 7 is bent in a circular shape making the teeth parts 4 to be on the inner diameter side.

#### 3. Detailed Explanation of the Invention

[Field of Utilization in Industry]

This invention relates to the structure of the electric motor in which the winding is made in the inner diameter of a small diameter iron core.

#### **[Existing Technology]**

In the electric motor with a small diameter, in the case of making the windings in the inner diameter side, it becomes difficult to wind when it becomes long in the axial direction.

Especially, when the diameter is small, in order to increase the output, the laminated amount of steel sheets must be increased, and it becomes even longer in the axial direction, and it becomes difficult to make the winding.

Therefore, until now, the method in which the iron core is divided in the direction of the diameter, and the winding is done on the inner diameter side, and thereafter, the divided parts are put together, has been used.

#### **[Problem That this Invention Intends to Solve]**

However, in the case of welding the divided parts, if the diameter is small, the winding on the inner diameter side becomes damaged by the effect of the welding heat, so that the joining by welding becomes practically difficult, so that mechanical joining must be done instead.

Mechanical joining is different from welding, and it does not cause any damage to the winding on the inner diameter side, however, in the case of an electric motor that is long in the axial direction, this can not accurately secure the space between it and the rotor that is provided on the inner diameter side, and this is a problem.

The objective of this invention is to solve this problem and to offer the electric motor

which can be easily produced with the structure that is long in the axial direction and which has a small diameter.

#### **[Method to Solve the Problem]**

In this invention the problems are solved by forming the teeth parts by providing a large opening on one side of a belt shaped steel sheet, and by forming the fan- shaped notches that are extended near the other side of the steel sheet at the bottom part of this opening, and by making the above mentioned steel sheet to be a constant length and also by laminating these to form the stator core, and by making the windings between the above mentioned teeth parts, and by bending the stator core into a circular shape making the teeth parts to be on the inner diameter side.

#### **[Operation]**

Before the stator core is bent, the winding can be done easily since the opening is opened large, and after the winding is done, the stator core is bent to make the circular shape, so that the stator core equipped with the winding can be formed.

#### **[Actual Example]**

This invention will be explained based on the actual example shown in the figures. Figure 1 is an angled view of the important parts of the stator core of the electric motor of an actual example of this invention. Figure 2 is the flat view that indicates the state of its assembly. Figure 3 shows the important parts of the opening.

In the electric motor shown in Figure 1, the opening 3 is provided on one side edge 2 of the belt shaped steel sheet 1, and the teeth parts 4 are formed between the adjoining openings 3, and the fan- shaped notch 5 is formed at the bottom of the opening 3, and this notch 5 is cut off until very near the other side edge 6 of the steel sheet 1.

The steel sheet 1 is laminated in many layers, and also it is made to be a consistent length, and it forms the stator core 7.

—In the electric motor shown in Figure 2, the stator core 7 is bent into a circular shape making the teeth parts 4 to be on the inner diameter side, and the winding 8 is installed in the opening 3.

When the stator core 7 is bent in a circular shape, the fan- shaped notches 5 are closed, and the sides of the fan shape are tightly attached.

In the stator core 7 that was bent in a circular shape, a cylinder shaped frame 9 is installed on the outside, and a bracket that is not shown in the figure is attached on this frame 9 at the end in the axial direction, and at the same time it is structured in the way that the rotor that is not shown in the figure is provided on the inner diameter side of the stator core 7.

In the opening 3 shown in Figure 3, the fan shaped notches 5 are formed at the bottom of the opening 3, and one side of the notch 5 is cut out until the position that is near the edge 6 of the other side of the steel sheet 1.

In the electric motor structured like this, the opening 3 and the notch 5 are formed on the steel sheet 1 by the press work, and it is laminated, and the stator core 7 is formed.

Then, after the winding is made on the opening 3, the stator core 7 is bent into a circular shape making the teeth parts 4 to be on the inner diameter side.

At this time, the stator core 7 can be bent easily since the notches 5 were made and

these are cut out until near the edge of the other side of the steel sheet 1.

In addition, when the stator core 7 is bent, the edges of the fan shaped notches 5 attach tightly, and by this, the magnetic resistance becomes less when it is completed as the electric motor.

The stator core 7 that was bent into a circular shape is inserted into a cylinder shaped frame 9, so that the circular shape can be maintained.

Also, the winding 8 is installed in the process prior to the bending of the stator core 7 into a circular shape, therefore, the opening 3 is opened large, and also it is installed on the stator core 7 in a flat shape, therefore, it can be installed without regard for the length in the axial direction.

In addition, as the result of bending the stator core 7 into a circular shape, even in the case when the inner diameter is extremely small in the electric motor, this has nothing to do with the installation of the winding 8, so that the winding can be made without regard for the inner diameter or the length in the axial direction.

#### **[Effect of the Invention]**

According to this invention, the winding can be done without regard for the inner diameter or the length in the axial direction, therefore, the electric motor with a small diameter and with a large output can be made, and this effect is extremely great.

#### **4. Simple Explanation of the Figures**

Figure 1 is an angled view of the important parts of the stator core of the electric motor of an actual example of this invention. Figure 2 is the flat view that indicates the state of

its assembly. Figure 3 shows the important parts of the opening.

- 1 ... Steel sheet
- 2 ... Edge of one side
- 3 ... Opening
- 4 ... Teeth part
- 5 ... Notch
- 6 ... Edge of the other side
- 7 ... Stator core
- 8 ... Winding

Applicant : Shibaura Seisakusho K.K.

Figure 1

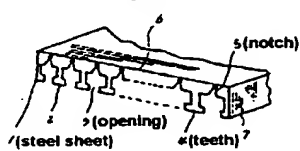


Figure 2

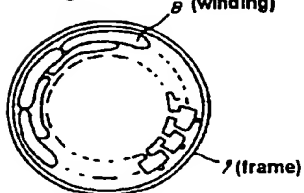
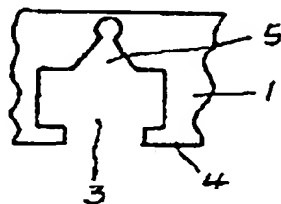


Figure 3



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⑪ 特許出願公開

⑫ 公開特許公報(A)

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⑮ 発明の名称 電動機

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⑰ 出 願 昭63(1988)3月31日

⑱ 発 明 者 入 江 真 一 郎 福井県小浜市駅前町13番10号 株式会社芝浦製作所小浜工場内

⑲ 出 願 人 株式会社芝浦製作所 東京都港区赤坂1丁目1番12号

明細書

1. 発明の名称

電動機

2. 特許請求の範囲

帯状の銅板1の一方の辺2に大きな開口3を併設して歯部4を形成し、この開口3の底部に銅板1の他方の辺6の近くまで延設される扇状の切欠5を形成し、前記銅板1を一定長にすると共に積層して固定子鉄心7とし、前記歯部4間に巻線8を施し、歯部4側を内径側として固定子鉄心7を円形に曲げたことを特徴とする電動機。

3. 発明の詳細説明

〔産業上の利用分野〕

本発明は、径の小さい鉄心の内径に巻線を施す電動機の構造に関する。

〔従来の技術〕

径の小さい電動機は、内径側に巻線を施す場合、軸方向に長くなると容易に巻線が施せなくなる。

特に、径が小さくなると出力を大きくするため銅板の積層量を大きくする必要があり、ますま

す軸方向に長くなり巻線を施すことが困難になる。

このため、従来、鉄心を径方向に分割して内径側に巻線を施し、後に分割部分を接合して組立てることが行われている。

〔発明が解決しようとする問題点〕

しかしながら、分割部分を溶接する場合、径が小さくなると溶接熱の影響で内径側の巻線を損傷するため、事実上溶接々合が困難となり、機械的結合を行うことになる。

機械的結合は、溶接と異なり、内径側の巻線に障害を発生することがないものの、軸方向に長い電動機では、内径側に備えられる回転子との空隙を正確に確保できなくなるといった問題を生じる。

本発明は、この様な問題点を解決し、径の小さい軸方向に長い構造で容易に製造できる電動機を提供することを目的としている。

〔問題点を解決するための手段〕

本発明は、帯状の銅板の一方の辺に大きな開口を併設して歯部を形成し、この開口の底部に銅板の他方の辺の近くまで延設される扇状の切欠を形



成し、前記鋼板を一定長にすると共に積層して固定子鉄心とし、前記歯部間に巻線を施し、歯部側を内径側として固定子鉄心を円形に曲げたことによって問題点を解決している。

#### 〔作用〕

固定子鉄心が曲げられるまでは、開口が大きく開いているため、巻線を容易に施すことができ、巻線が施された後、固定子鉄心を折り曲げて円形にすることによって巻線が内装された固定子鉄心を形成することができる。

#### 〔実施例〕

本発明を図面に示された一実施例に基づいて説明すると、第1図は、本発明の一実施例による電動機の固定子鉄心の要部斜視図であり、第2図は、その組み立て状態を示す平面図であり、第3図は、開口の要部を示す図である。

第1図において、電動機は、帯状の鋼板1の一方の辺2に開口3が併設されており、開口3は、隣設する開口3との間に歯部4を形成しており、開口3の底部には、扇状の切欠5が形成され、こ

し、固定子鉄心7を形成する。

そして、開口3に巻線を施してから、固定子鉄心7を歯部4を内径側として円形に曲げる。

この際、固定子鉄心7は、鋼板1の他方の辺6に近い位置まで切り取られた切欠5が形成されているため、容易に曲げることができる。

さらに、切欠5は、固定子鉄心7が曲げられることにより、扇状の切欠5の辺が密着することになり、電動機として完成した時に磁気抵抗が少なくなるように完成する。

円形に曲げられた固定子鉄心7は、筒状のフレーム9に挿入することによって円形が保持される。

また、巻線8は、固定子鉄心7が円形に曲げられる前の工程で装着されるため、開口3が大きく開口しており、しかも、平面状の固定子鉄心7に装着するため、軸方向の長さとは無関係に装着できる。

さらに、固定子鉄心7を円形に曲げた結果、極めて内径の小さい電動機となった場合でも、巻線8の装着とは無関係のため、軸方向の長さと共に

の切欠5は、鋼板1の他方の辺6に近くなるまで切り取られている。

そして、鋼板1は、多数積層されると共に一定の長さに形成され、固定子鉄心7を形成している。

第2図において、電動機は、固定子鉄心7が歯部4側を内径側として円形に曲げられており、開口3には、巻線8が装着されている。

そして、固定子鉄心7は、円形に曲げられる際、扇状の切欠5が閉じており、その扇状の辺が密着している。

円形に曲げられた固定子鉄心7は、外側に筒状のフレーム9が装着されており、このフレーム9の軸方向端部に図示されないブラケットが取り付けられると共に図示されない回転子を固定子鉄心7の内径側に備えるように構成されている。

第3図において、開口3は、底部に扇状の切欠5が形成されており、切欠5の一方は、鋼板1の他方の辺6に近い位置まで切り取られている。

この様な構成において、電動機は、鋼板1にプレスワークで開口3および切欠5を形成して積層

内径とは無関係に巻線が施せることになる。

#### 〔発明の効果〕

本発明によれば、軸方向の長さ及び内径に無関係に巻線が施せるため、径の小さい出力の大きい電動機を得ることができ、その効果は極めて大きいものである。

#### 4. 図面の簡単な説明

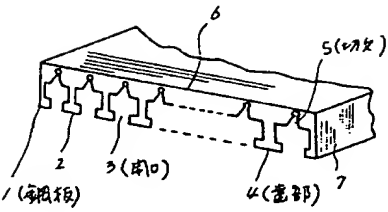
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1…鋼板、 2…一方の辺、 3…開口、 4…歯部、 5…切欠、 6…他方の辺、 7…固定子鉄心、 8…巻線。

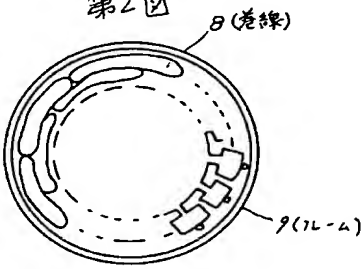
特許出願人

株式会社芝浦製作所

第1図



第2図



第3図

